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## FCC SAR Test Repor

Pupolsk Applicant RM Acquisition LLC.

> Anbolek 1100 West Idaho Street SUITE 310 Boise Address

**Idaho United States 83702** 

Product Name **Bluetooth Headset** 

Report Date Oct. 16, 2024

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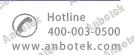
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Report No.:1812C400665125

FCC ID:A4C91005B

## **TEST REPORT**

Applicant : RM Acquisition LLC.

Manufacturer : RM Acquisition LLC.

Product Name : Bluetooth Headset

Model No. : ClearDryve 100S, CD100, CD180, CD210

Trade Mark : Rand McNally

Rating(s) : Battery: DC 3.7V

Test Standard(s) : IEEE Std 1528™-2013; FCC 47 CFR Part 2.1093;

ANSI/IEEE C95.1:2005; Reference FCC KDB 447498 D01 v06;

KDB 248227 D01 v02r02:

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the IEEE Std 1528™-2013, FCC 47 CFR Part 2.1093, IEEE Std C95.1-2005 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt Sept. 04, 2024

Date of Test Sept. 04, 2024 to Sept. 23, 2024

Prepared By

(Ella Liang)

Approved & Authorized Signer (KingKong Jin)

**Shenzhen Anbotek Compliance Laboratory Limited** 







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Report No.:1812C400665125 FCC ID:A4C91005B

## **Statement of Compliance**

## <Highest SAR Summary>

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2.1093 and IEEE Std C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528™-2013.

The maximum results of Specific All and the Temperature of Specific All a The maximum results of Specific Absorption Rate (SAR) found during testing are as follows.

#### <Highest SAR Summary>

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ľ	nest SAR Summary>	100	OK ANDO	- P	ek anbore	Bee.	
Frequency Band		Highest	Reported 1g-	SAR(W/Kg)	SAR Tes	t Limit	boles.
		Head (0mm)			(W/K	(g)	AUPOL
W.	BT	nbotek	And 0.296	"POFER	Vupole.	VU n	. 65
0	Test Result	olok.	PASS	Vun	anbolek 1.6	VUD.	f.e

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2.1093 and IEEE Std C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528™-2013.

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### **General Information**

#### 2.1. Client Information

6.	Applicant	:	RM Acqui	sition LLC.	Vupp 2015k	Aupoick	Vupole 118k	Wes Wholesh	
0	Address	:	1100 Wes	t Idaho Stree	t SUITE 310 I	Boise Idaho Ur	ited States 837	702	OFOR
	Manufacturer	:	RM Acqui	sition LLC.	ise. Vur.	Pulley Vu	boles Vupe	lok l	100m
N	Address	:	1100 Wes	t Idaho Stree	t SUITE 310 I	Boise Idaho Ur	nited States 837	702 NOK	20
00	Factory		N/A	VUPO!ER	No of State of the	VIPOICK	VURO ISH	Vupa	Ψ.
	Address		N/A	8 Upolok	Vupas.	in a spokely	VUPO LOS	V VIII	No

### 2.2. Description of Equipment Under Test (EUT)

	by.	<i>y</i> "	Which was the second of the se
199006	Product Name	:	Bluetooth Headset
ur ofe			ClearDryve 100S, CD100, CD180, CD210
BUDS	Model No.	:	(Note: All samples are the same except the model number, so we prepare
Pulc			"ClearDryve 100S" for test only.)
	Trade Mark	:	Rand McNally And Research Application And Annual An
Note.	Test Power Supply	:	DC 3.7V Battery And
ASTOOLE K	Test Sample No.	:	1-2-1(Engineering Sample)
y, alpose	Tx Frequency	:	BT BDR+EDR/BLE: 2402-2480MHz
De.	Type of Madulation		BT BDR+EDR: GFSK, π/4-DQPSK, 8-DPSK
Da	Type of Modulation	•	BT BLE: GFSK
le de la companya de	Category of device	:	Portable device
9.0	1-0x		No. VIII.

#### Remark:

The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Shenzhen Anbotek Compliance Laboratory Limited

Hotline 400-003-0500 www.anbotek.com





#### 2.3. Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

#### 2.4. Applied Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2.1093
- · IEEE Std C95.1-2005
  - IEEE Std 1528™-2013
- KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- KDB 865664 D02 RF Exposure Reporting v01r02
- KDB 447498 D01 General RF Exposure Guidance v06
- KDB 248227 D01 802 11 Wi-Fi SAR v02r02

#### 2.5. Environment of Test Site

Items	Required	155.9	Actual	6.00.6*
Temperature (°C)	18-25	Aupolek.	22~23	Aupolek Vupolek
Humidity (%RH)	30-70 Malo 1014	Vupo le	55~65	Vupo <sub>k</sub>

#### 2.6. Test Configuration

The device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT. The EUT was set from the emulator to radiate maximum output power during all tests. For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal.







## 3. Specific Absorption Rate (SAR)

## 3.1. Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

#### 3.2. SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$SAR = \frac{d}{dt} \left( \frac{dW}{dm} \right) = \frac{d}{dt} \left( \frac{dW}{\rho dv} \right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = C\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity,  $\delta T$  is the temperature rise and  $\delta t$  is the exposure duration, or related to the electrical field in the tissue by

$$SAR = \frac{\sigma |E|^2}{\rho}$$

Where: $\sigma$  is the conductivity of the tissue,  $\rho$  is the mass density of the tissue and E is the RMS electrical field strength.

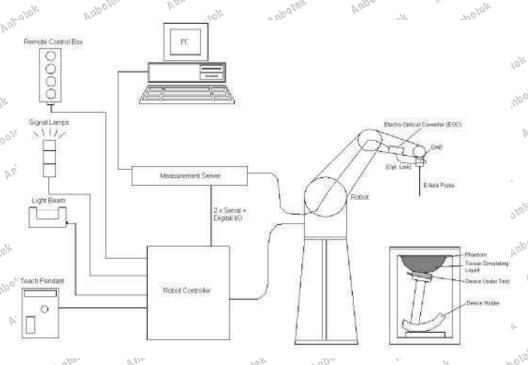
However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.







## 4. SAR Measurement System



**DASY System Configurations** 

The DASYsystem for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (EOC) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software

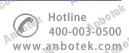
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- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

components are described in details in the following sub-sections.

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#### 4.1. E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

#### E-Field Probe Specification

#### <EX3DV4 Probe>

	100	, -							
Construction	Symmetrical design with triangular	-8							
	core Man Model A	00,							
	Built-in shielding against static charges								
	PEEK enclosure material (resistant to								
g.	organic solvents, e.g., DGBE)								
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB								
Directivity	± 0.3 dB in HSL (rotation around probe								
	axis) notek Antos	100							
	± 0.5 dB in tissue material (rotation								
	normal to probe axis)	P							
Dynamic Range	10 μW/g to 100 W/kg; Linearity: ± 0.2								
3	dB (noise: typically< 1 μW/g)								
Dimensions	Overall length: 330 mm (Tip: 20 mm)	Voy							
	Tip diameter: 2.5 mm (Body: 12 mm)	000							
	Typical distance from probe tip to	dn							
	dipole centers: 1 mm								



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#### E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm$  10%. The spherical isotropy shall be evaluated and within  $\pm$  0.25dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

#### 4.2. Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

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Photo of DAE Aupole

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## Anbolek 4.3. Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60XL) type from Stäubli SA (France). For the 6-axis controllersystem, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäublirobot series have many features that are important for our application: Anbolek

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High precision (repeatability ±0.035 mm)

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- High reliability (industrial design)
  - > Jerk-free straight movements

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Low ELF interference (the closed metallic construction shields against motor control fields)



**Photo of DASY5** 

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#### 4.4. Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128 MB), RAM (DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.



**Photo of Server for DASY5** 

## 4.5. Phantom

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#### <SAM Twin Phantom>

,		
	Shell Thickness	2 ± 0.2 mm;
P		Center ear point: 6 ± 0.2 mm
	Filling Volume	Approx. 25 liters
	Dimensions	Length: 1000 mm; Width: 500 mm;
V		Height: adjustable feet
	Measurement	Left Hand, Right Hand, Flat
0	Areas	Phantom Mark Thornes
9		Amborek Ambor Ak Abote
		ok spolek Aupor A. Stek Aupor A.
		Photo of SAM Phantom
		162 145 W

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.





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# <ELI4 Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx, 30 liters
Dimensions	Major ellipse axis: 600 mm
	Minor axis:400 mm
	rek Aupoten Aug
	tek hoolek Anoo
	Autoon of woles Williams Williams
	William Ville Villette W. Villette William Villette Ville
	Photo of ELI4 Phantom

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

#### 4.6. Device Holder

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of  $\pm 0.5$ mm would produce a SAR uncertainty of  $\pm 20\%$ . Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity  $\varepsilon$  = 3 and loss tangent  $\delta$  = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.



**Device Holder** 

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#### 4.7. Data Storage and Evaluation

#### Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [W/kg]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

#### Data Evaluation

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The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters: - Sensitivity Norm<sub>i</sub>, a<sub>i0</sub>, a<sub>i1</sub>, a<sub>i2</sub>

- Conversion factor ConvF<sub>i</sub>

- Diode compression point dcpi

**Device parameters:** Frequency f

- Crest factor cf

Media parameters: - Conductivity σ

- Density γ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

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The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

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with  $V_i$ = compensated signal of channel i, (i = x, y, z)

 $U_i$  = input signal of channel i, (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcp<sub>i</sub> = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated:

E-field Probes: 
$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field Probes: 
$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

with  $V_i$  = compensated signal of channel i,(i= x, y, z)

Norm<sub>i</sub>= sensor sensitivity of channel i, (i= x, y, z), µV/(V/m)<sup>2</sup> for E-field Probes

ConvF= sensitivity enhancement in solution

aii= sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

Ei= electric field strength of channel iin V/m

H<sub>i</sub>= magnetic field strength of channel iin A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with SAR = local specific absorption rate in W/kg

E<sub>tot</sub>= total field strength in V/m

 $\sigma$  = conductivity in [mho/m] or [Siemens/m]

 $\rho$  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.





## 5. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Carial Number	Calibration		
Manufacturer	Name of Equipment	Type/Model	Serial Number	Last Cal.	Due Date	
SPEAG	2450MHz System Validation Kit	D2450V2	910 And	Jun. 11,2024	Jun. 10,2027	
SPEAG	Data Acquisition Electronics	DAE4	nbolel387 An	Sept.02,2024	Sept.01,2025	
SPEAG	Dosimetric E-Field Probe	EX3DV4	7396	May 06,2024	May 05,2025	
Agilent	ENA Series Network Analyzer	E5071C	MY46317418	Oct.26, 2023	Oct.25, 2024	
SPEAG	otek AnDAK	DAK-3.5	1226	NCR	NCR	
SPEAG	SAM Twin Phantom	QD000P40CD	1802	NCR NCR	NCR NCR	
SPEAG	ELI Phantom	QDOVA004AA	olek 2058 <sub>Mabol</sub>	NCR	NCR NO	
AR	Amplifier Amplifier	ŽHL-42W	QA1118004	DOLE NCR AND	NCR	
Agilent	Power Meter	N1914A	MY50001102	Oct.26, 2023	Oct.25, 2024	
Agilent	Power Sensor	E9323A	US40410647	Jan. 23, 2024	Jan. 22, 2025	
Agilent	Power Sensor	E9323A	MY53100007	Jan. 23, 2024	Jan. 22, 2025	
CDKMV	Attenuator Market	6610	6610-1	Oct.20, 2023	Oct.19, 2024	
CDKMV	Attenuator	10010 Marie 6606 Marie 6606	6606-1	Oct.20, 2023	Oct.19, 2024	
Agilent	Spectrum Analyzer	N9020A	MY51170037	Oct.26, 2023	Oct.25, 2024	
Agilent	Signal Generation	N5182A	MY48180656	Oct.26, 2023	Oct.25, 2024	
Worken	Directional Coupler	0110A05601O- 10	COM5BNW1A 2	Oct.26, 2023	Oct.25, 2024	

#### Note:

- 1. The calibration certificate of DASY can be referred to appendix C of this report.
  - 2. The dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
  - The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
  - The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent.
  - 5. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it.

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## 6. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown as followed:



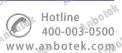
Photo of Liquid Height for Head SAR

The following table gives the recipes for tissue simulating liquid.

Frequency	Water	Sugar	Cellulose	Salt	Preventol	DGBE	Conductivity	Permittivity
(MHz)	(%)	(%)	(%)	(%)	(%)	(%)	(σ)	(εr)
VUA.	Vupojsk	Vupo	40 le	For H	ead nbore	Dec.	olek Vupok	Sie William
2450	55.0	0 %	0	0.3	0 400 0 kg	44.7	1.80	39.2 And

The following table shows the measuring results for simulating liquid.

	Measured	Target	Tissue	A* -	Measure	d Tissue	700		-1/10
S. C.	Frequency (MHz)	εr	σ	٤r	Dev. (%)	σ	Dev. (%)	Liquid Temp.	Test Data
	2450	39.2	1.80	39.08	-0.31	1.85	2.78 nbo	22.7	09/23/2024







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## 7. System Verification Procedures

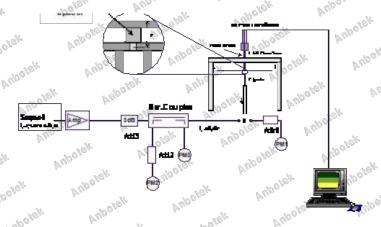
Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

#### Purpose of System Performance check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

#### System Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



System Setup for System Evaluation





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**Photo of Dipole Setup** 

#### > Validation Results

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Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10%. The table below shows the target SAR and measured SAR after normalized to 1W input power. It indicates that the system performance check can meet the Anborek variation criterion and the plots can be referred to Appendix A of this report.

<sup>Upojek</sup>	Date	Frequency (MHz)	Power fed onto reference dipole (mW)	Targeted SAR (W/kg)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)	ek Vu
VUO.	09/23/2024	2450 M	250	notel 52.4 And	12.95	51.8 AND	-1.15	10°
B	"Upp "POFSIF	Vupolek	Pupore	who tek	Anbore	Yun.	Vuporek	WUDO.

Target and Measurement SAR after Normalized Anbolek

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## 8. EUT Testing Position

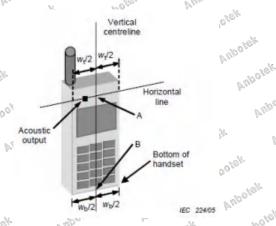
#### 8.1. Head Position

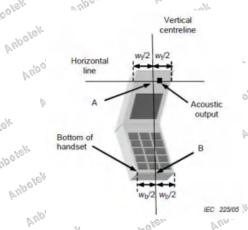
The wireless device define two imaginary lines on the handset, the vertical centreline and the horizontal line, for the handset in vertical orientation as shown in Figures 5a and 5b.

The vertical centreline passes through two points on the front side of the handset: the midpoint of the width  $W_t$  of the handset at the level of the acoustic output (point A in Figures 5a and 5b), and the midpoint of the width  $W_b$  of the bottom of the handset (point B).

**The horizontal line** is perpendicular to the vertical centreline and passes through the centre of the acoustic output (see Figures 5a and 5b). The two lines intersect at point A.

Note that for many handsets, point A coincides with the centre of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centreline is not necessarily parallel to the front face of the handset (see Figure 5b), especially for clam-shell handsets, handsets with flip cover pieces, and other irregularly shaped handsets.





Figures 5a

Figures 5b

W. polsk

- W<sub>t</sub> Width of the handset at the level of the acoustic
- W<sub>b</sub> Width of the bottom of the handset
  - A Midpoint of the widthwt of the handset at the level of the acoustic output
  - B Midpoint of the width wb of the bottom of the handset

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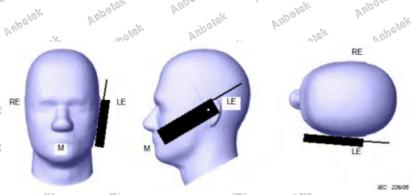
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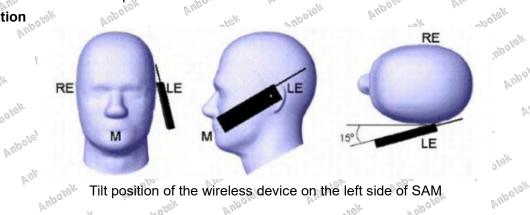
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#### 9. Measurement Procedures

The measurement procedures are as follows:

- (a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the middle channel.
- (b) Keep EUT to radiate maximum output power or 100% duty factor (if applicable)
- (c) Measure output power through RF cable and power meter.
- (d) Place the EUT in the positions as setup photos demonstrates.
- (e) Set scan area, grid size and other setting on the DASY software.
- (f) Measure SAR transmitting at the middle channel for all applicable exposure positions.
- (g) Identify the exposure position and device configuration resulting the highest SAR
- (h) Measure SAR at the lowest and highest channels attheworst exposure position and device configuration if applicable.

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan

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(d) Power drift measurement

#### 9.1. Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values form the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g







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#### 9.2. Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

#### 9.3. Area Scan Procedures

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6

		≤3 GHz	> 3 GHz
Maximum distance from closest measure (geometric center of probe sensors) to ph		5 ! 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to surface normal at the measurement location		$30^{\rm o}\pm1^{\rm o}$	20° ± 1°
		≤2 GHz: ≤15 mm 2 – 3 GHz: ≤12 mm	3 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
Maximum area scan spatial resolution: Δ:	mea the x or		on, is smaller than the above, must be ≤ the corresponding levice with at least one

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#### 9.4. Zoom Scan Procedures

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

, 0°		* 18 V V V V	≤ 3 GHz	> 3 GHz
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Maximum zoom scan s	patial reso	olution: Δx <sub>Zoom</sub> , Δy <sub>Zoom</sub>	$\leq$ 2 GHz: $\leq$ 8 mm 2 - 3 GHz: $\leq$ 5 mm*	$3 - 4 \text{ GHz:} \le 5 \text{ mm}^*$ $4 - 6 \text{ GHz:} \le 4 \text{ mm}^*$
	uniform	grid: Δz <sub>Zoom</sub> (n)	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
Maximum zoom scan spatial resolution, normal to phantom surface	graded	Δz <sub>Zoom</sub> (1): between 1 <sup>st</sup> two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
	grid	Δz <sub>Zoom</sub> (n>1); between subsequent points	≤1.5·Δ	Z <sub>Zoom</sub> (n-1)
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

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When zoom scan is required and the <u>reported</u> SAR from the <u>area scan based 1-g SAR estimation</u> procedures of KDB 447498 is  $\leq 1.4$  W/kg,  $\leq 8$  mm,  $\leq 7$  mm and  $\leq 5$  mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

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#### 9.5. Volume Scan Procedures

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The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregateSAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

#### 9.6. Power Drift Monitoring

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All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

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#### <Bluetooth Conducted Power>

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Mode	Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Average Power (dBm)	Tune-up power(dBm)
BT BDR	00	2402	10.486	7.887 nbokelk	8.00
(CECK)	39,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	2441	10.625	8.268	8.50
(GFSK)	78 NO	2480	9.896	7.396	7.50 nbotes
BT EDR	00	2402 And	11.720	9.320	9.50
(П/4DQPSK)	nb <sup>0</sup> 39	2441	11.831 no	9.422	9.50
(III-DQI OIL)	78 And 78	2480	11.149 And 1	8.645	9.00
RT END	000101	2402	11.751	9.254	9.50
	39	2441	11.850	Anbotek 9.351 Anbote	9.50
(ODI OIL)	78 <sup>An</sup>	2480 10010	11.178	8.677 Anh	9.00
	Drey 00 Vu	2402	8.148	6.648	7.00 And a
BT EDR (8DPSK) BT BLE_1M (GFSK)	19	2440	8.238 no o le la	6.737	7.00 An
(Ol Ok)	39	2480	7.556	6.057	6.50
RTRIF 2M	Pu000	2402	And 8.083	6.582	7.00
BT BLE_2M (GFSK)	190000	2440	8.254	6.758	7.00
(Or Oit)	4 39 Mapol	2480	7.594	6.091	6.50
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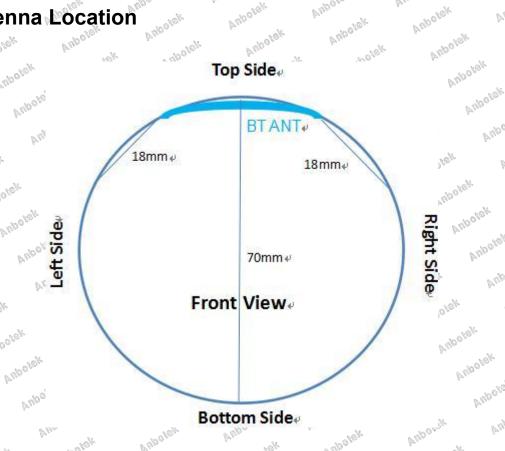
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### **Antenna Location**

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		Positions	for SAR tests	; Head mode		
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
BT ANT	Yes	And Yes	Yes	No And	Yes	Yes Andoor

General Note: According with FCC KDB 447498 D01, appendix A, <SAR test exclusion thresholds for 100MHz~6GHz and≤50mm>table, this device SAR test configurations considerations are shown in the table above.

Per KDB 447498 D01, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.

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## 12. SAR Test Results Summary

General Note:

1.Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.

Scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.

Reported SAR(W/kg)= Measured SAR(W/kg)\* Scaling Factor

- 2.Per KDB 447498 D01v06, for each exposure position, if the highest output channel reported SAR≤0.8W/kg, other channels SAR testing are not necessary
- 3.Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg, only one repeated measurement is required.
- 4. When the user enables the personal Wireless router functions for the handsets, actual operations include simultaneous transmission of both the Wi-Fi transmitting frequency and thus cannot be evaluated for SAR under actual use conditions. The "Portable Hotspot" feature on the handset was

NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

#### 12.1. Head SAR Results

#### <BT>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch	Freq. (MHz	e	Tune-U p Limit (dBm)	Scalin g Factor	r Drift	Measure d SAR <sub>1g</sub> (W/kg)	Reporte d SAR <sub>1g</sub> (W/kg)
"polek	BT EDR	П/4DQPSK	√e Left	PUP.	39	2441	9.422	9.50	1.018	-0.12	0.131	0.133
200	BT EDR	П/4DQPSK	Right	0000	39	2441	9.422	9.50	1.018	0.07	0.128	0.130
#1	BT EDR	П/4DQPSK	Тор	0	39	2441	9.422	9.50	1.018	0.17	0.291	0.296
8	BT EDR	П/4DQPSK	Тор	0	00	2402	9.320	9.50	1.042	-0.01	0.277	0.289
6	BTEDR	П/4DQPSK	Toplogic	0	78	2480	8.645	9.00	1.085	0.05	0.202	0.219
NOK.	BT EDR	П/4DQPSK	Front	Q <sub>NO</sub>	39	2441	9.422	9.50	1.018	0.13	0.152	0.155
· a	BT EDR	П/4DQPSK	Back	0,6	- 39	2441	9.422	9.50	1.018	0.11	0.144	0.147
Vupoje	BT EDR	П/4DQPSK	Bottom	APO	39	2441	9.422	9.50	1.018	N/A	N/A	N/A

#### Note:

- 1. Per KDB 865664 D01V01,for each frequency band ,repeated SAR measurement is required only when the measured SAR is≥0.8W/Kg.
- 2. Per KDB 865664 D01V01,if the ratio of largest to smallest SAR for the original and first repeated measurement is≤1.2and the measured SAR<1.45W/Kg, only one repeated measurement is required.
- 3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45W/Kg
- 4. The ratio is the difference in percentage between original and repeated measured SAR.

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## **Measurement Uncertainty**

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## Appendix A. EUT Photos and Test Setup Photos

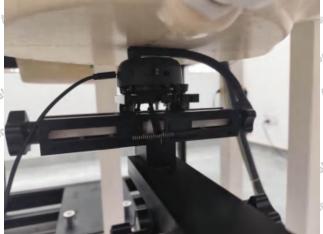
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## Appendix B. Plots of SAR System Check

2450MHz Head System Check

Date:09/23/2024

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DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 910

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2450 MHz;  $\sigma = 1.85 \text{S/m}$ ;  $\epsilon r = 39.08$ ;  $\rho = 1000 \text{ kg/m}$ 3

Phantom section: Flat Section

#### **DASY5 Configuration:**

Probe: EX3DV4 - SN7396; ConvF(7.57, 7.57, 7.57); Calibrated: May 06, 2024;

Sensor-Surface: 3mm (Mechanical Surface Detection) Electronics: DAE4 Sn387; Calibrated: Sep.02.2024;

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Area Scan (61x91x1): Measurement grid: dx=10.00 mm, dy=10.00 mm

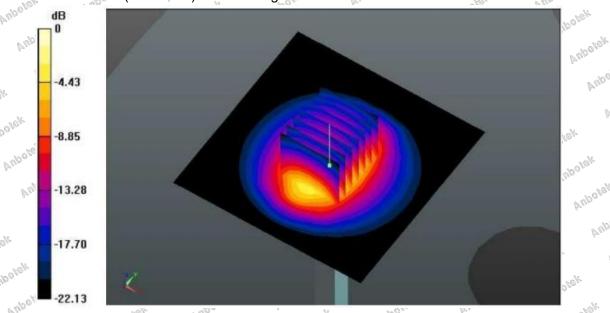
Maximum value of SAR (interpolated) = 19.664 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 84.571 V/m; Power Drift = 0.05 dB

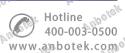
Peak SAR (extrapolated) = 26.125 W/kg

SAR(1 g) = 12.95 W/kg; SAR(10 g) = 5.92 W/kg Maximum value of SAR (measured) = 19.47W/kg



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## Appendix C. Plots of SAR Test Data

Date: 09/19/2024

#### BT EDR II/4DQPSK CH39 Head Top

Communication System: UID 0, Frequency: 2441 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2441 MHz;  $\sigma = 1.85$  S/m;  $\varepsilon_r = 39.08$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

#### DASY5 Configuration:

•Probe: EX3DV4 - SN7396; ConvF(7.57, 7.57, 7.57); Calibrated: May 06.2024;

Sensor-Surface: 4mm (Mechanical Surface Detection)

•Electronics: DAE4 Sn387; Calibrated: Sep.02,2024

•Phantom: SAM 1; Type: SAM;

•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Head/Top /Area Scan (51x151x1): Measurement grid: dx=1.200mm, dy=1.200mm

Maximum value of SAR (measured) = 1.645 W/kg

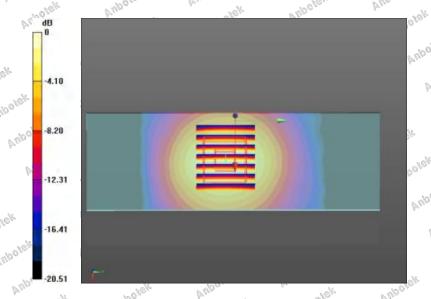
Head/Top /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.512 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.641 W/kg

SAR(1 g) = 0.291 W/kg; SAR(10 g) = 0.144 W/kg

Maximum value of SAR (measured) = 0.347 W/kg



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## Aupole) Appendix A. DASY System Calibration Certificate

Schmid & Partner Engineering AG

e a

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 44 245 9700, Fax +41 44 245 9779 info@speag.com, http://www.speag.com

#### IMPORTANT NOTICE

#### **USAGE OF THE DAE 4**

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and diff accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

#### Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the Estop assembly is allowed by certified SPEAG personnel only and is part of the annual

#### Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

TN\_BR040315AD DAE4.doc

11.12.2009

Shenzhen Anbotek Compliance Laboratory Limited

Code:AB-RF-05-b

Hotline 400-003-0500 www.anbotek.com



Address: Sogood Industrial Zone Laboratory & 1/F. of Building D, Sogood Science and Fechnology Park, Sanwei Community, Hangcheng Subdistrict, Bao'an District, Shenzhen, Guangdong, China

Email: service@anbotek.com Tel:(86)0755-26066440



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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





Schweizerischer Kalibrierdienst S Service suisse d'étalonnage C Servizio svizzero di taratura Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Anbotek (Auden) Client

Accreditation No.: SCS 0108

Certificate No: DAE4-387 Sep02

#### CALIBRATION CERTIFICATE

Object

DAE4 - SD 000 D04 BM - SN: 387

Calibration procedure(s)

QA CAL-06.v29

Calibration procedure for the data acquisition electronics (DAE)

Calibration date:

September 02, 2024

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	15-Aug-24 (No:22092)	Aug-24
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	05-Jan-24 (in house check)	In house check: Jan-24
Calibrator Box V2.1	SE UMS 006 AA 1002	05-Jan-24 (in house check)	In house check: Jan-24

Calibrated by:

Name Function Dominique Steffen Laboratory Technician

Approved by:

This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Address: Sogood Industrial Zone Laboratory & 1/F. of Building D, Sogood Science and Pechnology Park,

Sven Kühn

Deputy Manager

Issued: September 02, 2024

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S Swiss Calibration Service

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Glossary

DAE data acquisition electronics

Connector angle information used in DASY system to align probe sensor X to the robot

coordinate system.

#### Methods Applied and Interpretation of Parameters

 DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.

- Connector angle: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - DC Voltage Measurement Linearity: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - Common mode sensitivity: Influence of a positive or negative common mode voltage on the differential measurement.
  - Channel separation: Influence of a voltage on the neighbor channels not subject to an input voltage.
  - AD Converter Values with inputs shorted: Values on the internal AD converter corresponding to zero input voltage
  - Input Offset Measurement: Output voltage and statistical results over a large number of zero voltage measurements.
  - Input Offset Current: Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - Input resistance: Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - Low Battery Alarm Voltage: Typical value for information. Below this voltage, a battery alarm signal is generated.
  - Power consumption: Typical value for information. Supply currents in various operating modes.

Certificate No: DAE4-387\_Sep02

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**DC Voltage Measurement** 

A/D - Converter Resolution nominal

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High Range: 1LSB = 6.1µV, full range = -100...+300 mV Low Range: 1LSB = 61nV . full range = -1.....+3mV DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

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Calibration Factors	x	Y	Z
High Range	404.489 ± 0.02% (k=2)	404.852 ± 0.02% (k=2)	404.862 ± 0.02% (k=2)
Low Range	3.97827 ± 1.50% (k=2)	3.95875 ± 1.50% (k=2)	3.97982 ± 1.50% (k=2)

#### Connector Angle

Connector Angle to be used in DASY system	53.0°+1°

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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

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High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	200032.85	-3.31	-0.00
Channel X + Input	20007.64	1.88	0.01
Channel X - Input	-20003.48	1.18	-0.01
Channel Y + Input	200034.23	-1.43	-0.00
Channel Y + Input	20006.60	0.91	0.00
Channel Y - Input	-20004.04	0.72	-0.00
Channel Z + Input	200035.38	-0.83	-0.00
Channel Z + Input	20003.69	-2.11	-0.01
Channel Z - Input	-20006.38	-1.59	0.01

Low Range	Reading (µV)	Difference (μV)	Error (%)
Channel X + Input	2001.63	0.08	0.00
Channel X + Input	202.29	0.70	0.35
Channel X - Input	-197.90	0.60	-0.30
Channel Y + Input	2001,33	-0.07	-0.00
Channel Y + Input	200.86	-0.60	-0.30
Channel Y - Input	-199.87	-1.23	0.62
Channel Z + Input	2001.61	0.27	0.01
Channel Z + Input	200.60	-0.70	-0.35
Channel Z - Input	-199.51	-0.85	0.43

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	13.50	11.56
	- 200	-8.64	-11.18
Channel Y	200	-0.81	-1.28
	- 200	1.05	0.09
Channel Z	200	7.17	6.91
	- 200	-9.46	-9.01

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

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	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	-1.70	0.33
Channel Y	200	10.70	-	-0.38
Channel Z	200	7.11	7.89	

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DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15969	17466
Channel Y	15661	16162
Channel Z	15990	16190

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (µV)
Channel X	0.73	-2.58	3.29	0.62
Channel Y	0.41	-0.49	1.23	0.40
Channel Z	-0.80	-1.88	0.30	0.42

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values Alarm Level (VDC)		
Supply (+ Vcc)	+7.9	
Supply (- Vcc)	-7.6	

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

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Client Anbotek (Auden) Certificate No: Z24-98671

## CALIBRATION CERTIFICATE

Object EX3DV4 - SN:7396

Calibration Procedure(s) FF-Z12-006-08

Calibration Procedures for Dosimetric E-field Probes

Calibration date: May 06, 2024

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)© and humidity<70%.

#### Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	20-Jun-23 (CTTL, No.J23 X07447)	Jun-23
Power sensor NRP-Z91	101547	20-Jun-23 (CTTL, No.J23 X07447)	Jun-23
Power sensor NRP-Z91	101548	20-Jun-23 (CTTL, No.J23 X07447)	Jun-23
Reference10dBAttenuator	18N50W-10dB	13-Mar-24(CTTL,No.J24X01547)	Mar-24
Reference20dBAttenuator	18N50W-20dB	13-Mar-24(CTTL, No.J24X01548)	Mar-24
Reference Probe EX3DV4	SN 7433	26-Sep-23(SPEAG,No.EX3-7433_Sep22)	Sep-23
DAE4	SN 549	13-Dec-23(SPEAG, No.DAE4-549_Dec22)	Dec -23
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-23 (CTTL, No.J23X04776)	Jun-23
Network Analyzer E5071C	MY46110673	13-Jan-24 (CTTL, No.J24X00285)	Jan -24
	Name	Function	Signature

Calibrated by: Yu Zongying SAR Test Engineer

Reviewed by: Lin Hao SAR Test Engineer

Approved by: Qi Dianyuan SAR Project Leader

Issued: May06, 2024

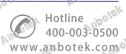
This calibration certificate shall not be reproduced except in full without written approval of the laboratory

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# Probe EX3DV4

SN: 7396

Calibrated: May 06, 2024

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

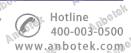
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## DASY/EASY - Parameters of Probe: EX3DV4 - SN: 7396

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(µV/(V/m)2)A	0.54	0.53	0.50	±10.0%
DCP(mV) <sup>B</sup>	97.8	104.5	102.5	1000

### Modulation Calibration Parameters

UID	Communication System Name	10-1	A dB	B dBõV	C	D dB	VR mV	Unc E (k=2)
0 CW	X	0.0	0.0	1.0	0.00	199.9	±2.4%	
		Y	0.0	0.0	1.0		203.3	
		Z	0.0	0.0	1.0		195.0	

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

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A The uncertainties of Norm X, Y, Z do not affect the E2-field uncertainty inside TSL (see Page 5 and Page 6).

<sup>&</sup>lt;sup>6</sup> Numerical linearization parameter: uncertainty not required.

E Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



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## DASY/EASY - Parameters of Probe: EX3DV4 - SN: 7396

#### Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] <sup>C</sup>	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	9.82	9.82	9.82	0.30	0.85	±12.1%
835	41.5	0.90	9.71	9.71	9.71	0.15	1.36	±12.1%
900	41.5	0.97	9.87	9.87	9.87	0.16	1.37	+12.1%
1750	40.1	1.37	8.61	8.61	8.61	0.25	1.04	±12.1%
1900	40.0	1.40	8.13	8.13	8.13	0.24	1.01	±12.1%
2100	39.8	1.49	8.14	8.14	8.14	0.24	1.04	+12.1%
2300	39.5	1.67	7.85	7.85	7.85	0.40	0.75	±12.1%
2450	39.2	1.80	7.57	7.57	7.57	0.50	0.75	1 12.1%
2600	39.0	1.98	7.38	7.38	7.38	0.64	0.68	±12.1%
5250	35.9	4.71	5.33	5.33	5.33	0.45	1.30	+13.3%
5600	35.5	5.07	4.89	4.89	4.89	0.45	1.35	±13.3%
5750	35.4	5.22	4.92	4.92	4.92	0.45	1.45	=13.3%

Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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F At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

GAlpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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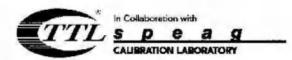
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## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7396

### Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] <sup>©</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	10.09	10.09	10.09	0.30	0.90	±12.1%
835	55.2	0.97	9.88	9.88	9.88	0.19	1.32	+12.1%
900	55.0	1.05	9.82	9.82	9.82	0.23	1.15	±12,1%
1750	53.4	1.49	8.24	8.24	8.24	0.24	1.06	±12.1%
1900	53.3	1.52	7.97	7.97	7.97	0.19	1.24	±12.1%
2100	53.2	1.62	8.18	8.18	8.18	0.19	1.39	±12.1%
2300	52.9	1.81	7.88	7.88	7.88	0.55	0.80	±12.1%
2450	52.7	1.95	7.53	7.53	7.53	0.45	0.89	±12.1%
2600	52.5	2.16	7.38	7.38	7.38	0.52	0.80	±12.1%
5250	48.9	5.36	4.93	4.93	4.93	0.45	1.80	±13.3%
5600	48.5	5.77	4.19	4.19	4.19	0.48	1.90	± 13.3%
5750	48.3	5.94	4.52	4.52	4.52	0.48	1.95	±13.3%

<sup>&</sup>lt;sup>c</sup> Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>&</sup>lt;sup>6</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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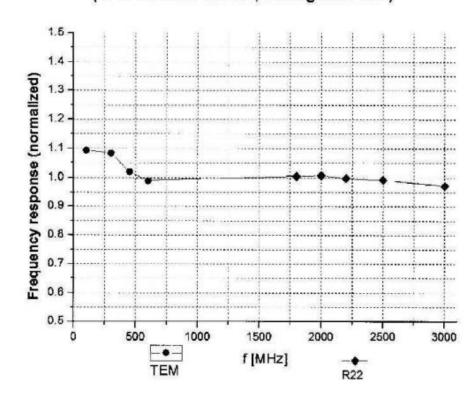
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## Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.4% (k=2)

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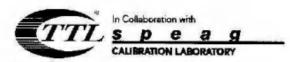
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## Receiving Pattern (Φ), θ=0°

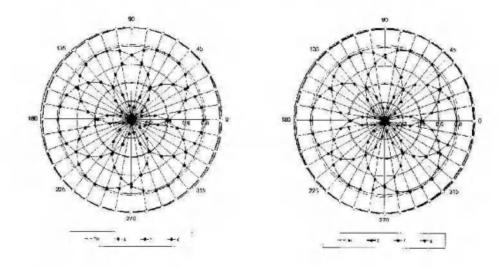
## f=600 MHz, TEM

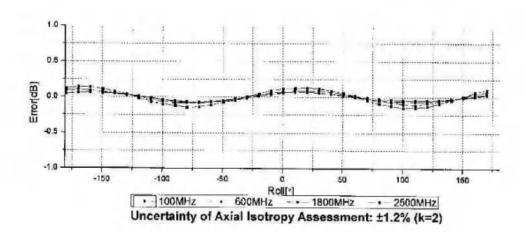
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## f=1800 MHz, R22





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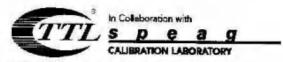
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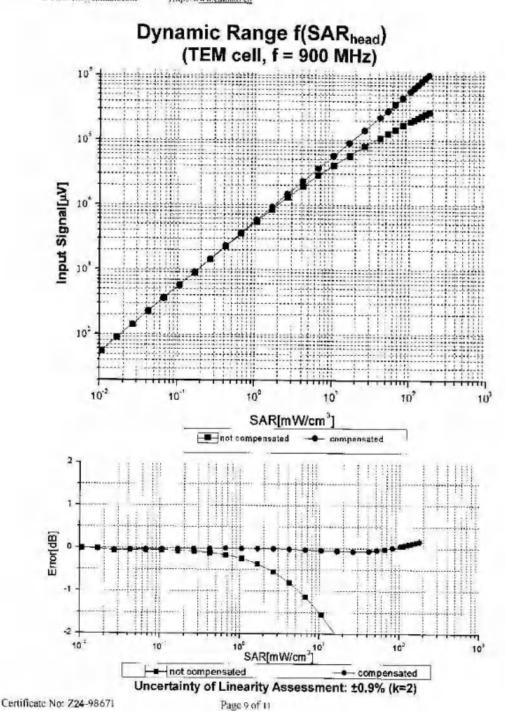
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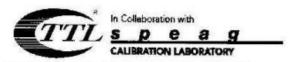
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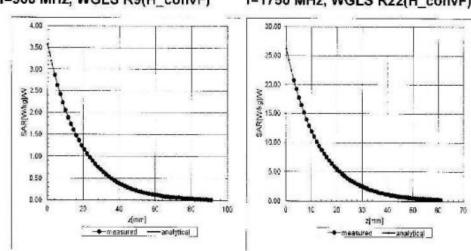
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## Conversion Factor Assessment

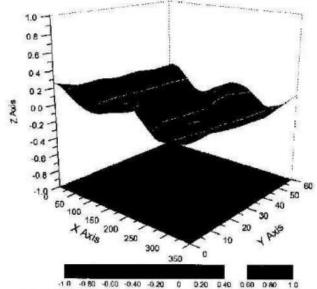
## f=900 MHz, WGLS R9(H\_convF)

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## f=1750 MHz, WGLS R22(H\_convF)



## Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (K=2)

Certificate No: 724-98671

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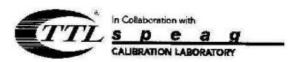
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## DASY/EASY - Parameters of Probe: EX3DV4 - SN: 7396

Other Probe Parameters

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Sensor Arrangement	Triangular
Connector Angle (°)	156.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

Certificate No: Z24-98671

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Client

Anbotek (Auden)

Z24-97091 Certificate No:

### CALIBRATION CERTIFICATE

Object D2450V2 - SN: 910

Calibration Procedure(s) FD-Z24-2-003-01

Calibration Procedures for dipole validation kits

Calibration date: Jun 11, 2024

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3) To and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-23 (CTTL, No.J23X04256)	Jun-24
Power sensor NRP-Z91	101547	01-Jul-23 (CTTL, No.J23X04256)	Jun-24
Reference Probe EX3DV4	SN 7307	19-Feb-24(SPEAG,No.EX3-7307_Feb24)	Feb-25
DAE4	SN 771	02-Feb-24(CTTL-SPEAG,No.Z24-97011)	Feb-25
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-24 (CTTL, No.J24X00893)	Jan-25
Network Analyzer E5071C	MY46110673	26-Jan-24 (CTTL, No.J24X00894)	Jan-25

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	2
Reviewed by:	Qi Dianyuan	SAR Project Leader	wor
Approved by:	Lu Bingsong	Deputy Director of the laboratory	In with

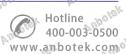
Issued: Jun 12, 2024

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z24-97091 Page 1 of 8

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Glossary:

TSL tissue simulating liquid

ConvF sensitivity in TSL / NORMx,y,z N/A not applicable or not measured

## Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

e) DASY4/5 System Handbook

## Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.

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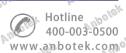
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

Certificate No: Z24-97091

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#### **Measurement Conditions**

DASY system configuration, as far as not given on page 1

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.77 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

Condition	
250 mW input power	13.0 mW / g
normalized to 1W	52.4 mW /g ± 20.8 % (k=2)
Condition	
250 mW input power	6.06 mW / g
normalized to 1W	24.3 mW /g ± 20.4 % (k=2)
	250 mW input power normalized to 1W Condition 250 mW input power

### **Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.97 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

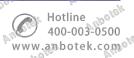
SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.8 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.18 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.7 mW /g ± 20.4 % (k=2)

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#### **Appendix**

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.6Ω+ 2.77jΩ	
Return Loss	- 25.8dB	

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.7Ω+ 4.28jΩ	
Return Loss	- 27.3dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1,263 ns
Electrical Delay (one direction)	1.200 110

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Date: 06.11.2024

Autolisk

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910 Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz;  $\sigma = 1.767$  S/m;  $\epsilon r = 39.01$ ;  $\rho = 1000$  kg/m3

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN7307; ConvF(7.36, 7.36, 7.36); Calibrated: 2/19/2021;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2021-02-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

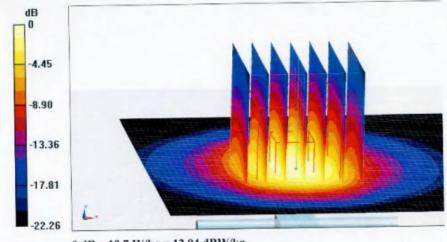
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,

dy=5mm, dz=5mm

Reference Value = 106.5 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 13 W/kg; SAR(10 g) = 6.06 W/kg Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

Certificate No: Z24-97091

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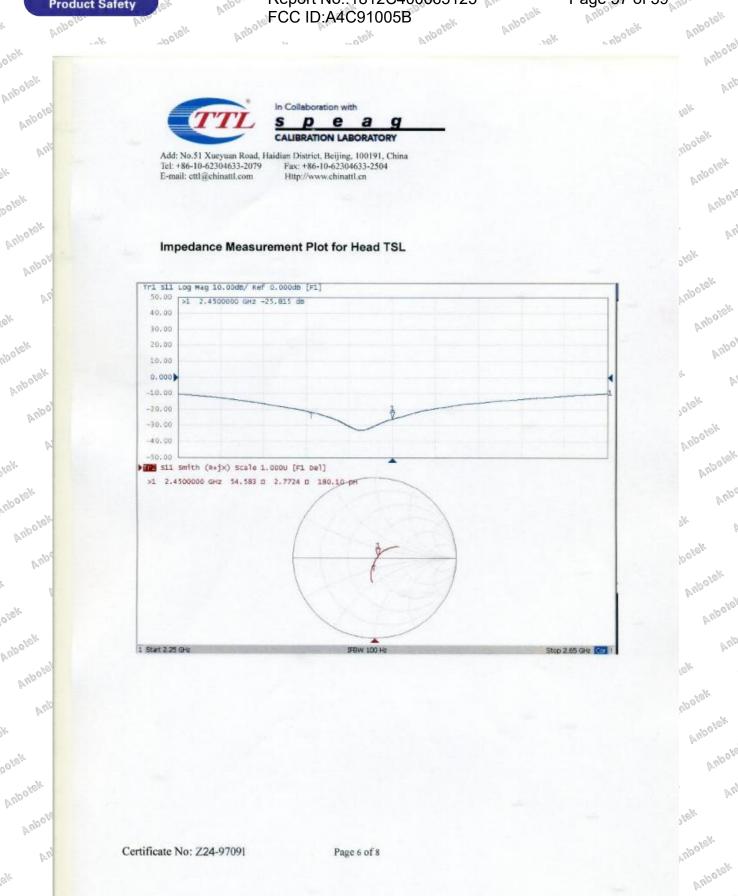
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DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China

Date: 06.11.2024

Aupolisk

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz;  $\sigma = 1.972 \text{ S/m}$ ;  $\varepsilon_r = 52.92$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN7307; ConvF(7.22, 7.22, 7.22); Calibrated: 2/19/2021;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2021-02-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,

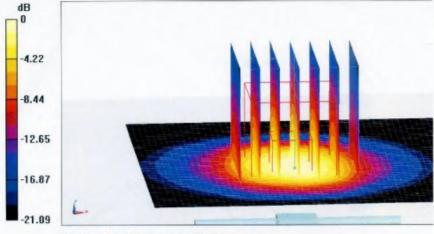
dy=5mm, dz=5mm

Reference Value = 98.89 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 25.6 W/kg

SAR(1 g) = 13 W/kg; SAR(10 g) = 6.18 W/kg

Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Certificate No: Z24-97091

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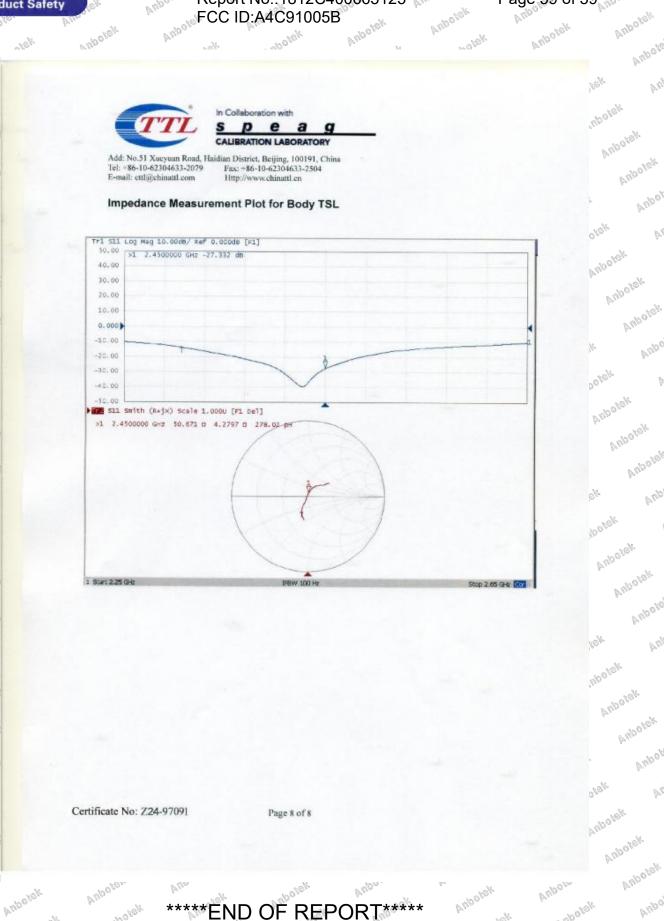
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